

INTERNATIONAL PRELIMINARY
REPORT ON PATENTABILITY
(SEPARATE SHEET)

PCT/IB2005/000195

Re Item V

**Reasoned statement with regard to novelty, inventive step or industrial applicability;
citations and explanations supporting such statement**

Reference is made to the following documents:

D1: US-A-5 951 431
D3: WO 89/10501 A
D5: EP-A-1 433 978

D2: DE 101 41 995 A1
D4: US-A-3 901 103
D6: JP 58 144141 U

1. Novelty of independent claim 1

The document D1 is regarded as being the closest prior art to the subject-matter of claim 1 and discloses (the references in parentheses applying to this document):

a differential gear unit (Figure 9) which divides an input driving force into a first output and second output and permits a difference between a rotational speed of the first output and a rotational speed of the second output, and which includes a casing (150) that defines an internal space (platitude) and an opening (122a, 122b) communicated with the internal space and that is rotatable in a given rotational direction and in a rotational direction opposite to the given rotational direction (around B), the casing including an input portion (24) in which the driving force is input,
- rotation in the given direction is rotation around a longitudinal axis (B) of the differential gear casing,
- wherein a dividing mechanism (30, 34, 36) which is provided in the internal space and which divides the driving force into the first output and the second output (36);
- and a support member (30) which is provided so as to contact the casing and so as to support the dividing mechanism are further provided (Figure 9), wherein,
- the dividing mechanism includes a pinion (34), and the support member includes a pinion shaft (30) which supports the pinion such that the pinion can rotate on its axis and which makes the pinion revolve around a center of the casing (Figure 9),
- the opening is in a basically elliptical shape (Figures 2, 3, 4, 6) having a round shape at each of corner portions (Figures 2, 3, 4, 6), and the round shapes of the adjacent corner portions are different from each other (Figures 2, 3, 4, 6).

**INTERNATIONAL PRELIMINARY
REPORT ON PATENTABILITY
(SEPARATE SHEET)**

International application No.

PCT/IB2005/000195

The subject-matter of claim 1 differs from this known gearbox in document D1 in that

- a curvature radius of the round shape of the corner portion of the opening where a tensile stress is generated when the driving force is input in the given rotational direction is larger than a curvature radius of the round shape of the corner portion of the opening, where a compression stress is generated when the driving force is input in the given rotational direction;
- the casing is configured such that fatigue life of the casing when the driving force is repeatedly input in the input portion in the given rotational direction is longer than fatigue life of the casing when the driving force is repeatedly input in the input portion in the rotational direction opposite to the given rotational direction;
- the fatigue life of the casing is adjusted by making a shape of the opening asymmetrical with respect to a rotational axis of the casing;
- the fatigue life of the casing is adjusted by performing heat treatment on a corner portion of the opening of the casing;
- a heat treatment is performed on the corner portion of the opening of the casing, where a tensile stress is generated when the driving force is input in the given rotational direction.

The subject-matter of claim 1 is therefore considered to be new (Article 33(2) PCT).

2. Inventive step of independent claim 1

The problem to be solved by the present invention may therefore be regarded as to provide a differential gear unit which can withstand a large driving force at a low weight and size.

The solution in claim 1 is not contained in or does not seem to be rendered obvious from the state of the art as mentioned in the search report.

The present claim 1 seems therefore to fulfil the provisions of Art 33 (3) PCT.

3. Industrial applicability

The application seems to fulfil the provisions of Art. 33 (4) PCT, because the corresponding differential gear unit can be produced and used at least in the transmission industry.

4. Dependent claims 2 to 7

**INTERNATIONAL PRELIMINARY
REPORT ON PATENTABILITY
(SEPARATE SHEET)**

International application No.

PCT/IB2005/000195

The subject-matter of dependent claims 2 to 7 have as subject-matter special embodiments of the invention according to claim 1 and seem to fulfil the requirements of Article 33(2) to (4) PCT.

5. Remarks

- Although claim 1 is drafted in the two-part form, some features are incorrectly placed in the characterising portion, as they are disclosed in document D1 in combination with the features placed in the preamble (Rule 6.3(b) PCT).
- Claim 1 does not meet the requirements of Article 6 PCT in that the claim several times uses the word "wherein" and it is not always possible to undoubtedly identify, which feature this word "wherein" refers to. Moreover, in claim 1 "a center of the casing" is not defined (it has been interpreted as the rotation axis of the input portion 110).
- Claims 1, 2 and 3 do not meet the requirements of Rule 6.2(b) PCT because some reference signs are missing (for instance: a longitudinal axis, a dividing mechanism, a support member, support portion).
- A feature in claim 1 is not supported by the description (Article 6 PCT): "the fatigue life of the casing is adjusted by performing heat treatment on a corner portion (121, 122, 123, 124) of the opening (120h) of the casing (120)". According to the description not all the corners are subject to a heat treatment. Similarly, a physical treatment on all corners of the opening of the casing is not supported by the description (Article 6 PCT).
- The reference to claim 1 in claim 3 is not correct (Rule 6.4 PCT): the feature "support portion" is not mentioned in claim 1.
- Because of the symmetrical shape of the opening with respect to the rotational axis (100a) the second embodiment of the invention (paragraph 12 and 51 and further Figure 12) does not fall within the scope of the claims. This inconsistency between the claims and the description leads to doubt concerning the matter for which protection is sought, thereby rendering the claims unclear (Article 6 PCT).
- In paragraph 23, as explanation to Figure 2, a cross sectional view taken along line II-II in

**INTERNATIONAL PRELIMINARY
REPORT ON PATENTABILITY
(SEPARATE SHEET)**

International application No.

PCT/IB2005/000195

Figure 1 is given which is not correct. If it were so, the hole 125 in Figure 2 should be visible in view (i.e. a complete circle) and not in section (as parallel lines, as it is in Figure 2). Figure 2 is a cross sectional view of Figure 1 taken by a plane parallel with the plane of the paper and not by a plane perpendicular to the plane of the paper, as it is given in Figure 1.